Kempenfelt Math Trail

Mathematicians:

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LOCATION 1

Brainstorm
math trail activities based on flags, flagpoles or tall things.

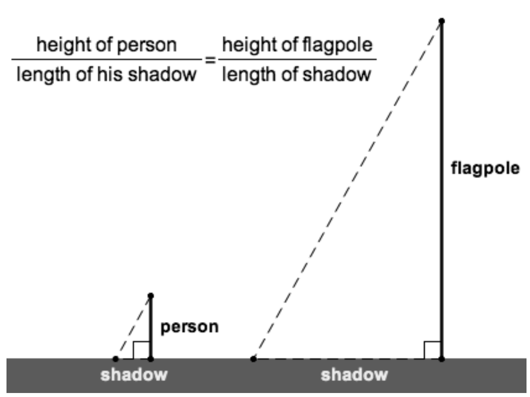
Go to the location shown in the picture.

1. Usually a flag is at the top of the flagpole. Sometimes the flag is flown halfway down the pole. This is a symbol of respect, mourning or distress. It is called flying a flag at half-mast. Draw a picture of a flag at half-mast.

2. a) Draw some flags that are $\frac{1}{2}$ blue, $\frac{1}{3}$ red, and $\frac{1}{6}$ white.
   b) If the red part is 1 whole unit, what would you call the blue part? the white part?
   c) Which part (blue, red or white) has the largest area? Why?
   d) I am thinking of a fraction that is between $\frac{1}{2}$ and $\frac{1}{3}$. What could it be?

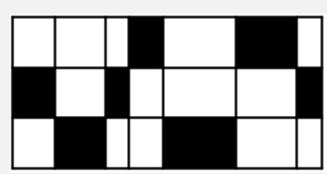
3. Sheila drew a flag and said it was $\frac{1}{2}$ red and $\frac{3}{5}$ blue. Is this possible? Why or why not?

4. Estimate the height of the flagpole using proportional reasoning. Hint:



Research-Informed Instruction:
- Require students to partition an area model to represent a specific fractional value
- Engage students in activities which extend their concept of unit
- Encourage students to find fractions between close fractions

☺ What fraction of this flag is shaded?



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LOCATION 2
Brainstorm
math trail activities based on parking lots, vehicles or transportation.

Go to the parking lot above the tennis courts.

1. Use fractions to make comparison statements about a large car and a smaller car (e.g., the width of the smaller car is about 5/6 of the width of the larger car).

2. Pick a license plate that has at least 3 digits in it.
Your challenge is to use some or all of its digits to make some fractions. What's the smallest fraction you can make?
(Example: 1V2 3K7 has the digits 1, 2, 3, and 7. Derek made the fraction $\frac{1}{27}$ but Jared made one that was even smaller!)

3. Partners: Pick a car. Fill in the blanks with an estimate how long it would take you to wash the car.
Me: ________ minutes Partner: ________ minutes
(This is a lot more interesting if you choose different numbers!)
If you use your estimated rates, how long would it take both of you to wash that car together?

4. Read the following information which came from the website:
http://www.ehow.com/about_6716884_metric-vs_-sae-sizes.html
SAE Units
SAE measurement standards are those defined by the society of automotive engineers. This society defines standards for tools and parts used in both the automotive and aerospace industries. The units used for tools are selected rational values of inches, where a rational number is an integer or a fraction.

Conversion Between SAE and Metric Units
It is possible to theoretically convert between SAE and metric units, but there may not necessarily be an exact equivalent tool available in the alternative units. To convert from metric to SAE, multiply the value in millimeters by 25.4, and to do the opposite conversion multiply the SAE value by 0.039. As an example, if you have a bolt that is 3/8-inch in SAE units and you have metric wrenches then you will want to convert it to millimeters: The value 3/8-inch is equal to 9.5 mm, which does not precisely match the values that metric wrenches have in millimeters

This information doesn't make sense to Jason. He needs to know which metric size is needed to fix a 5/8-inch bolt. How would you help him?

Research-Informed Instruction:
- Present students with problems and ask them to use what they know to determine what they do not know.
- Have students determine the correctness of their solution.
- Develop situational understanding in conjunction with mathematical understanding.

☺

"Is it not clear, however, that bliss and envy are the numerator and denominator of the fraction called happiness?"
Yevgeny Zamyatin

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Research-Informed Instruction:
- Engage students in activities which extend their concept of unit.
- Present students with problems and ask them to use what they know to determine what they do not know.

LOCATION 3

Brainstorm
math trail activities based on cylinders, "invisible" wholes, or fence posts.

Go to the parking lots and look for a sonotube.

1. a) What fraction of the tube do you think you see above the ground?

   b) Use your fraction to estimate the total length of the tube.

2. Estimate the amount of concrete used to make the tube.

3. Back at the ranch: The depth of a sonotube is based on the frost line. Investigate building codes in your area to determine the appropriate depth for a sonotube.

4. Make a cylinder from this piece of paper. Use the long side to form the circular base. When you make the cylinder, the lines on this paper become similar to the "line" on the sonotube. How would you estimate the length of the line on the sonotube?

   (Note: Large storage containers often have a staircase that follows a line like this one.)

☺ A newspaper published a story saying that one-half of the lights on a city street were burned out.

Someone at the city took great exception to that and demanded a retraction and an apology.

The newspaper responded the next day with an apology and reported that one-half of the lights were not burned out.

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Mathematicians:

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LOCATION 4

Brainstorm
math trail activities based on lines, lengths or a sports area.

Mythconception:
A larger denominator means a larger amount.

Discussion:
How might you dispel this myth?

Go to the location shown in the picture.

1. a) Choose one of the lines on the tennis court. Walk the line using very BIG steps. Record the number of BIG steps. Walk the line again using very small steps. Record the number of small steps.

   b) Each type of step is a fraction of the length of the line.
   Write a fraction in each blank:
   1 BIG step = _______ line
   1 small step = _______ line

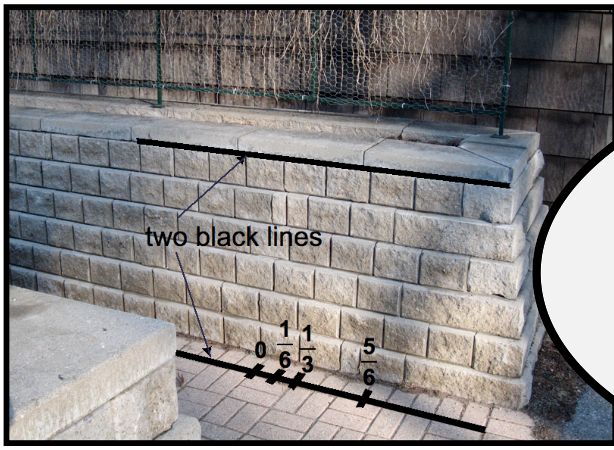
   c) Compare the step sizes.

How might this activity help a kinesthetic learner understand a comparison of unit fractions like $\frac{1}{10}$ *and* $\frac{1}{3}$*?*

☺ **Teacher: How much is half of 8?**
Student: Up and down or across?
Teacher: What do you mean?
Student: Well, up and down makes a 3 or across the middle makes a 0.

Kempenfelt Math Trail

Mathematicians:



Research-Informed Instruction:
- Use number lines to represent fractional amounts
- Recognize that a fraction on a number line is the distance from 0 rather than a portion of the entire number line
- Examine relationships between equivalent fractions

Go to the garden shed between Mardon Lodge and Bayview.

1a) Find the length represented by the top black line in the picture.
Now, let's say that length is 1 unit.
Now estimate the following:
length of 1 of the long blocks above the line is about _______ unit
length of 1 of the short blocks below the line is about _______ unit

1b) Divide your group into 2 teams and a "tracer".
Practice skip counting. How?
While the "tracer" drags a finger along the location shown by the top black line, Team A skip counts fractional parts based on the length of a large block. At the same time, Team B skip counts fractional parts based on the smaller blocks. It will sound like this:

Team A →	0 thirds			1 third			2 thirds
Team B →	0 ninths	1 ninth	2 ninths	3 ninths	4 ninths	5 ninths	6 ninths

What did you notice?

2. Team Game:
Find the place represented by the bottom black line in the picture.
Imagine this is a number line with equally spaced tick marks.

Team A	Team B
• Choose a tick mark to represent zero. • Choose a proper fraction to represent the distance between two of the tick marks (e.g., one-sixth). • Name two more tick marks along your number line. • Share the last 2 fraction names (e.g., one-third and five-sixths) and locations with Team B. • Shhhh! Don't tell Team B where zero is!	Your challenge is to determine Team A's secret location for zero.

LOCATION 5

Brainstorm math trail activities based on bricks, blocks or number lines.

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Rational people are partial to fractions.

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Mathematicians:

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LOCATION 6

Brainstorm
math trail activities based on signs.

Mythconception:
Fractions are added together by adding the top numbers then adding the bottom numbers.

Discussion:
How might you dispel this myth?

Go to the location shown in the picture.

1. Record the missing word: _______________

   a) Let's say that one whole set is ALL the letters in all the words. What fraction of that whole set is vowels?
   Answer: ______

   b) Derek's solution to part (a) looks like this:
   $$\frac{4}{7}+\frac{2}{5}+\frac{2}{6}+\frac{2}{4}=\frac{10}{22}$$
   What would you say to Derek about his solution?

2. Choose A or B.
   Is the statement sometimes, always, or never true?
   A: $\frac{2}{3}+\frac{1}{4}=\frac{3}{7}$ B: $\frac{2}{3}+\frac{1}{\Delta}=\frac{3}{\lozenge}$

☺ **Son:** Dad, can you help me find the lowest common denominator in this problem please? **Dad:** Don't tell me they haven't found it yet, I remember looking for it when I was a boy.

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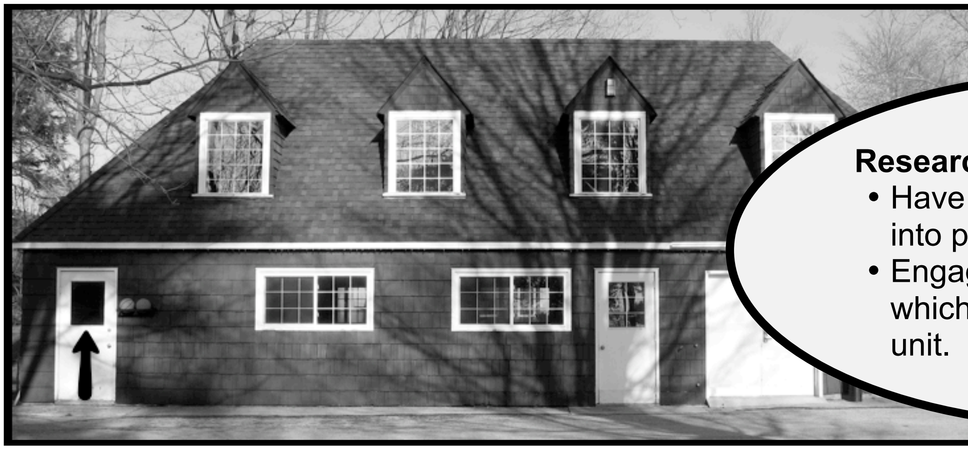
Mathematicians:



Research-Informed Instruction:
- Have students break fractions into parts.
- Engage students in activities which extend their concept of unit.

LOCATION 7

Brainstorm math trail activities based on windows.

Go to the location shown in the picture.

1. **The Best Window Cleaner Recipe**
   $\frac{1}{4}$ cup vinegar, $\frac{1}{2}$ tsp liquid soap, 2 cups water

   a) Estimate the amount of window cleaner Hal needs to clean all of these windows?
   b) About how much of Hal's window cleaner will be vinegar?

2. An arrow is pointing to one of the 9 windows. Let's say that the area of glass in that window is 1 square unit. Estimate the total area of glass in all 9 windows.

3. Complete this equation to represent the area of glass in all 9 windows.

$$\frac{?}{?}+\frac{?}{?}+\frac{?}{?}+\frac{?}{?}+\frac{?}{?}+\frac{?}{?}+\frac{?}{?}+\frac{?}{?}+\frac{?}{?}=\mathbf{1}$$

☺

T: If I had five bottles of vinegar and I gave you three, how many would I have left?
S: I don't know.
T: Why?
S: In our school we do all our arithmetic in apples and oranges.

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Mathematicians:

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LOCATION 8

Brainstorm
math trail activities based on game areas, flowers, or a garden.

Go to the 2 horseshoe pits located between Bayview and the lake.

1. Make a "horseshoe" flower. The set of horseshoes in your flower is 1 whole. Count all the horseshoes as fractions of the whole.
   Example: Jody uses 5 horseshoes to make a flower with 5 petals. She counted the horseshoes like this: one-fifth, two-fifths, three-fifths and so on.)

2. Look for some real flowers and practice counting by unit fractions.

3. a) Look for the four horseshoe posts and notice that the posts are vertices of a rectangle. Have a team member stand at each of the 4 posts. Now, each of the 4 people should get ready to move in a clockwise direction along a side of the rectangle toward the next post.
   b) Have each person move one-half of the distance toward the next post. Now, the 4 people are standing at the 4 vertices of a different quadrilateral. What type of quadrilateral is this? Would the type of quadrilateral be the same or different if the people had walked two-thirds of the distance?
   c) Make some conclusions and share your reasoning.

Research-Informed Instruction:

- Engage students in counting by unit fractions.
- Engage students in activities which extend their concept of unit.

☺

$$\frac{1}{?}+\frac{1}{?}+\frac{1}{?}=\frac{1}{5}$$

If all the question marks represent the same number, what could the number be?

If each question mark represents a different number, what could the numbers be?

Kempenfelt Math Trail

Mathematicians:

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Question:
How can you drop an egg six and a half metres without breaking it?
Answer:
Drop it from seven metres.

Research-Informed Instruction:
Include models with a perceptual distractor.

Go to the location shown in the picture.

1. a) Have each team member shoot 4 times. Keep a record of the baskets.

Name	1	2	3	4

b) Erik got 1 basket in 4 shots. He represented his score as $\frac{1}{4}$.
He also represented his score as a picture by shading 2 of the 8 sections on the basketball picture. Do you agree or disagree with his representations? Why?

2. The volume of a different ball is twice the volume of your basketball. Andy says that means the radius is also twice as large. Do you agree or disagree?

3. Compare each pair of scores. Which score is better, A or B?

	A	B
a)	$\frac{5}{9}$	$\frac{5}{8}$
b)	$\frac{5}{9}$	$\frac{4}{9}$
c)	$\frac{3}{5}$	$\frac{5}{11}$
d)	$\frac{10}{22}$	$\frac{7}{13}$

4. Pick any pair of scores from question 3. Find a third score, C, that is between the other two scores.

LOCATION 9

Brainstorm
math trail activities based on basketball or balls.

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Research-Informed Instruction:
- Construct connections between fractions, multiplication, and division through exploration in context of fair sharing
- Engage students in counting by unit fractions

Go to the shore of Lake Simcoe.

1. Read this news clipping:
CTVNews.ca Date: Fri. Mar. 9 2012 11:19 PM ET
A large rescue effort was launched Friday afternoon to save a group of 27 ice fishermen who were marooned on a disintegrating ice floe on Ontario's Lake Simcoe. The group, which included a 12-year-old boy, had been fishing on a chunk of ice when it broke away from the shore around noon local time. The ice floe was originally about two kilometres long, but strong winds began to break it up as it drifted away from shore.

Reagan looked at the picture and counted 20 pieces of ice. She said that each piece is one-twentieth. Do you agree or disagree?

2. a) Collect a handful of pebbles. Could you make equal shares for 2 people? 3 people? 4 people? 5 people?
b) Find two twigs where one is half as long as the other.
c) Use some beach objects to create your own fraction question.

3. A Fermi question involves making estimations and reasonable assumptions. It can also involve very big numbers. Try one of these examples:
How many rocks are on the shore in front of the Kempenfelt Conference Centre?

Make your own Fermi question for a team mate to solve.

LOCATION 10

Brainstorm
math trail activities that focus on the environment, rocks, twigs or water.

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Question:
A child playing on the beach had 6 1/6 sandpiles in one place and 3 1/3 in another. If he put them all together, how many sandpiles would he have?

Answer:
Only one.

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Mathematicians:

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Sometimes, Always or Never True?

- a fraction is a small piece of a whole
- a fraction is smaller than one
- a fraction can be written in lots of different ways
- a fraction can be written as a decimal

Go to the patio in front of Mardon Lodge.

1. What fraction of the set of chairs is white?
2. Make a set of 3 chairs. If 1 whole is 3 chairs, what is 6 chairs? 5 chairs? 20 chairs?
3. An estimate of the volume of water in Lake Simcoe is 11.6 km^3. Create a fraction question that uses this information.
4. Have a seat and think of different ways you could solve this riddle:
   My towing rope was cut in half and half was thrown away.
   The other half was cut again, one third along its way.
   The longer part (ten metres length) is what I use today.
   But how long was my towing rope before this cutting fray?

   (credits: http://www.hawaii.edu/suremath/k4_12dir/k4_12menu.html)

☺

Question: How do we know that the following fractions are in Europe?

$\frac{a}{c}$ $\frac{x}{c}$ $\frac{w}{c}$

Answer: They are all over c's.

LOCATION 11

Brainstorm math trail activities that use chairs, water or riddles.

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Mathematicians:

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LOCATION 12

Brainstorm
math trail activities based on lights or furniture.

Research-Informed Instruction:

- Engage students in counting by unit fractions
- Engage students in activities which extend their concept of unit

Go inside Mardon Lodge and look up at the lights.

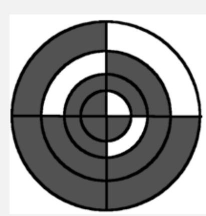
1. Let’s say a set of 6 lights is 1 whole. So 1 light is one-sixth. Skip count all of the lights in 1 chandelier (or all chandeliers).

2. There are three chandeliers and each chandelier has 6 lights. Name 2 of the lights as a fraction of a whole in lots of different ways. (Hint: use different wholes, use equivalent fractions).

3. Estimate the pitch or slope of the roof of this room.

4. Sidney put some coins on the coffee table. One half of the coins were tails ups. Sidney turned over 2 of the coins. Then, one third of the coins were tails up. How many coins did Sidney put on the table?

☺ Ryan painted this design on the coffee table. What fraction of the area of the design is shaded?



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Mathematicians:

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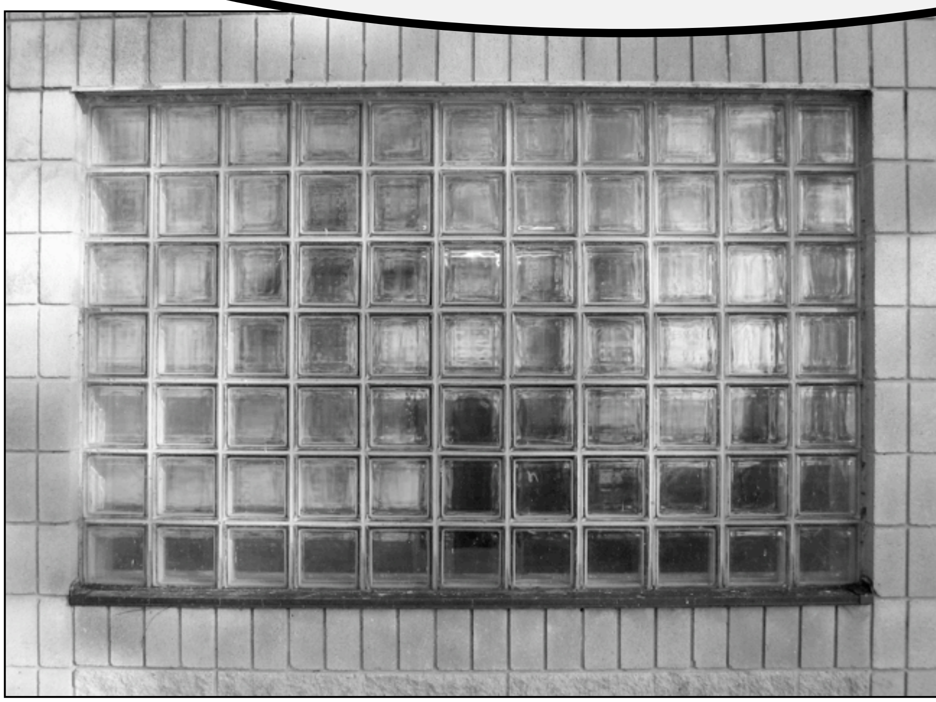
Research-Informed Instruction:
- incorporate a variety of models and contexts into instruction
- make strong connections between physical models and mathematical concepts
- establish the meaning of the fraction in the given context

LOCATION 13

Brainstorm math trail activities based on grids, windows or tiles.



Go to the lakeside of the main building and look for this window.

1. Jazmine looks at this window and sees a model for 11 x 7. What are a few ways she could use this location to model $\frac{1}{11}$?
2. Turn and Talk: How might you use an area to model $\frac{3}{4}\times\frac{4}{5}$?
3. Use the edges of the windows to compare attributes of one block of glass with one brick in the wall.
4. Use the glass grid to show that a line segment with a slope of $\frac{3}{4}$ is steeper than a line segment with a slope of $\frac{3}{8}$.

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Question 1: How can half of twelve be seven? **Answer 1:** Cut XII into two halves horizontally.

Question 2: How can 7 be even? **Answer 2:** Remove the first one-fifth of the letters in seven.

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Mathematicians:

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Research Informed Instruction:

- Encourage students in counting by unit fractions.
- Engage students in activities which extend their concept of unit.
- Ask students to represent fractions using a variety of number lines.

LOCATION 14

Brainstorm math trail activities based on stairs.

Go to the dining room to find this set of stairs.

1. Turn and Talk:
   a) How would you find the slope of these stairs?
   b) Tula said that if each step was twice as high and twice as long, then the slope would be twice as large. Do you agree? Why or why not?

2. a) Bruce practiced counting unit fractions by walking up and down these stairs. He counted up or down one step as one-fifth. Count out loud as you walk from the bottom to the top of the staircase and back down again (i.e., one-fifth, two-fifths, three-fifths and so on).
   b) If you kept walking up and down, where would you be when you reached $3\frac{2}{5}$?

   c) Bruce changed the count of 1 step to one-tenth. If Bruce started at the bottom of the staircase, where would he be for each of the following?
   $\frac{7}{10}$ $\frac{3}{10}$ $\frac{21}{10}$ $\frac{1}{5}$ $\frac{7}{5}$ $\frac{1}{2}$ $1\frac{1}{2}$

3. Order the fractions in question 2c from largest to smallest.

☺

$$\frac{1}{?}+\frac{1}{?}+\frac{1}{?}=\frac{1}{5}$$

If all the question marks represent the same number, what could the number be?

If each question mark represents a different number, what could the numbers be?